STARTERS FOR SCIENCE

- Short videos to get started with practical science enquiry
- Can be used in school or at home
- Minimal resources needed

Each video includes:

- A question or scenario related to the real world
- Time for children to think about what they already know
- A demonstration of a starter practical activity
- Time for children to think of their own questions
- Ideas about what they could find out for themselves
- Encouragement to share what they found with others

Supporting notes for teachers

Short descriptions of the science behind each video, plus some top tips

1. Paper Towers

Engineers and architects need to make structures that are strong and efficient, and to do this they must use the strongest shapes for their designs. Cylinders are very strong under stress and this is why space helmets and storage tanks are that shape. Hexagonal shapes are also very strong; they can be seen in honeycomb. Triangles allow weight to be distributed evenly, making them a good choice for building bridges.

TOP TIP Ask children to predict which shape will be strongest before they carry out their tower investigation. Can they give a reason for their prediction?

2. Straw Planes

The two hoops on the straw plane help keep it balanced and in the air: they are streamlined so that air moves easily around and through them, and they also create 'drag' (or air resistance) to keep the plane level. The amount of force applied when launching the plane as well as the size and shape of the straw and hoops, will all affect how far the plane travels. The force given to real planes, comes from the thrust of the engines that push them upwards; these engines are powered by fuel.

TOP TIP Can the children find patterns if they change one part of their straw plane? For example, does a plane with a longer straw fly further?

Starters for Science are created by the Primary Science Teaching Trust

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3. Paper Flowers

Paper is made of tiny, interwoven wood fibres which water molecules are drawn to; this results in the water travelling through the paper which is called capillary action. When the paper of the flower absorbs the water (through this capillary action), it swells; this creates the force that causes the flower to open. Different types of paper and cardboard will absorb water at varying rates, causing the flowers to open at different speeds. Paper towels absorb water easily, which is why they are so useful for cleaning up spilt liquid.

TOP TIP Prompt the children to draw a results table to collect their findings. Can they repeat their tests to check the accuracy of their results?

4. Shadow Puppets

Shadows are formed when objects block light coming from a light source. In the video, the light is coming from a mobile phone and the figure is made from cardboard, which is an opaque material and so blocks the light. If the light source or the figure is moved, the shadow also moves. The closer the light source is to the object, the bigger the shadow. The further away the light source is from the object, the smaller the shadow. In the summer we often sit under parasols or umbrellas, which shade us from sunlight by creating a shadow.

TOP TIP Can the children predict what will happen before they move the object creating the shadow? Will the shadow get larger or smaller? Will the same happen if they move the light source?

5. Falling Paper

When something falls, the object is being pulled down by the force of gravity but at the same time, experiences air resistance pushing it upwards. If an object has a large surface area, it will experience more air resistance. The stronger the air resistance, the more slowly the object will fall. In the video, the sheet of paper has a larger surface area than the crumpled ball of paper, and so it falls more slowly. Parachutes use air resistance to allow people to land safely on the ground by slowing down their fall.

TOP TIP Look for different ways of accurately timing the fall of the paper: slow motion video on a mobile phone is a great tool for this. Challenge the children to draw a results table. Can they repeat their results and calculate averages?

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6. Levers and Catapults

A lever is a simple type of machine that has a pivot point which allows us to move things using less effort. In the video, there are different examples of *levers*:

- The *spoon* pivots on the edge of the can and allows the top to be removed easily.
- The *plank of wood* pivots on the block on the floor. If a person is near the pivot and there is a long lever, it is possible to lift them using just one finger!
- The *catapult* is made from a spoon on a cylindrical object; it makes things fly through the air.

Scissors are like two levers put together – the longer the handles, the easier it is to cut.

TOP TIP Encourage children to use a trial-and-error approach, making notes as they go along. Can they demonstrate their final catapult to another person and explain what changes they made and why?

7. Animal Camouflage

Camouflage is a form of visual disguise. If something is the same colour as its surroundings it allows it to blend into the background and make it difficult to see; this is a form of camouflage. Some animals use camouflage to hide from other animals. This could be to protect themselves from predators, or so that their prey cannot see them coming, e.g. tiger stripes give camouflage in the jungle so that prey they are hunting cannot see them easily. Soldiers wear camouflage clothing to stop them being seen easily by the enemy.

TOP TIP Encourage children to record how near they need to be to see their camouflaged animals. Can they find which animals are most difficult to see and why?

8. Mirrors and Light

Light travels in straight lines until it hits an object. This might be a dull or dark object that absorbs most of the light or a shiny object that reflects the light and changes its direction. We are able to see things that give out their own light (a light source) or reflect light into our eyes. When light is reflected, it bounces off the surface and travels away at an equal and opposite angle to the light from the light source. The more shiny and smooth the surface, the better it reflects light; dark, dull and rough objects do not reflect light well. Shiny surfaces allow an image to form, which is why mirrors are shiny and smooth. Mirrors in cars are used for safety, so drivers can see what is behind them.

TOP TIP Remind children that they need to be careful not to direct light towards anybody's face. Encourage children to experiment with different numbers of shiny objects to direct light around something and record their findings. Can they draw how light travels from the light source?

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9. Melting Ice

The freezing point of a liquid is the temperature at which it changes state to form a solid. The freezing point of water is 0°C and at all temperatures below this, water will be in a solid state, i.e. ice. The temperature in most rooms is over 20°C and so the ice in the video will melt as heat energy is transferred to it through the air. If the material or sock containing the ice is a good thermal insulator, the heat energy will take longer to transfer, and the ice will melt more slowly. If the material is a poor thermal insulator, the energy transfer to the ice will be faster and the ice will melt more quickly. We often think of insulators as keeping things warm, but they also keep things cold: packed lunch bags are often padded to keep food cool; oven mitts work by stopping the heat from the oven reaching our hands.

TOP TIP Prompt the children to predict which material will be the best insulator and draw their own results table to collect their findings. Can they repeat their tests to check the accuracy of their results?

10. Paper Friction

Friction is a force between two surfaces that are moving across each other. Friction works in the direction opposite to the direction in which an object is moving and so slows the object down. The amount of friction between objects depends on their surfaces; the rougher the surface the more friction is created when the objects move past each other. Friction can be a useful force: it can stop our shoes from slipping on the pavement and car tyres from skidding on the road. Sometimes, however, we want to reduce friction: ice skaters have blades on their shoes so they can glide over ice, oil is used in the working parts of cars and bikes so that they can move more easily.

TOP TIP As well as encouraging the children to make predictions about which books will be most difficult to pull apart, challenge them to explain what they have found out using scientific words or drawing a diagram.

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11. Pendulum Timers

A pendulum is a mass (usually called a bob) that is hung from a fixed point and can swing freely. When the mass is pulled upwards and then released, the force of gravity pulls it back down and this is what causes the mass to swing from side to side. The scientific term for this swinging motion is oscillation. Swings at the park are examples of pendulums. Traditional clocks use mechanisms that include a pendulum; the pendulum swings back and forward at the same speed, marking time. Changing the length of the string will make a difference to the time it takes for the pendulum to do one swing; the longer the string, the longer one swing takes. Changing the mass of the bob on the end of the string does not change the length of time taken for one swing. Attaching card to the bob will slow the pendulum down because the card will increase the air resistance on the bob. In general, the bigger the card, the greater the air resistance will be.

TOP TIP Ask children to create a table in order to record their findings. Can they take repeat readings to check the accuracy of their results?

12. Spinning Paper

When the paper is released, the force of gravity pulls it down and makes it fall through the air. The wings of the paper create 'drag' (or air resistance) which slows it down. The structure of the paper will change how it falls, whether it spins and how quickly it reaches the ground. These can include: the size of the paper, what type of paper it is, how large the wings are and how they are shaped.
Dandelions use air resistance to disperse their seeds, which are very light and have feathery bristles to catch the breeze as they fall. Seeds need to be dispersed away from the parent plant so that they are not competing for space, water, nutrients and light. Each dandelion has many seeds to make sure that at least some of them land where they can grow. This is why we see so many of them!

TOP TIP Ask the children to change one thing about their spinner and design a fair test to see how much that changes its fall. Can they test different versions of their paper against each other?
HEALTH AND SAFETY Check the children have a safe method of releasing their paper to avoid accidents.

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13. Blowing Bubbles

The bubbles created by blowing through wands are pockets of gas (the air that is blown) wrapped in a soap film. The soap film is made from soap and water which work together to hold the air inside. How long they last will depend on whether they land on something sharp or whether the water in the soap film evaporates.
The bubbles in the fizzy drink are different because they contain carbon dioxide, which is what forces the bubbles to the surface of the liquid. At first, the raisins sink because they are denser than the liquid, but when the bubbles begin to attach themselves to the rough surface of the raisins this makes them less dense and able to rise. When the raisins reach the surface, the bubbles pop and the raisins sink back down.

TOP TIP Ask the children to choose one of these types of bubbles to explore. If they explore blowing bubbles, can they find any difference if they do this outside instead of inside? If they are exploring fizzy liquid, can they record how many times a raisin floats to the surface in a set time?

14. Colourful Ink

Inks are complex mixtures that are made up of more than one thing (or substance). Chromatography is a way of separating these substances and identifying them. Police work often involves using chromatography to identify different substances, this helps them solve crimes. The colours in the ink behave differently when the water travels through the paper, travelling at different speeds as the water is absorbed. This is what separates out the colours so that we can see and identify them.

TOP TIP Prompt the children to record their findings and repeat each one to check for accuracy.

15. Making Music

When the glass is tapped with the spoon or the elastic band is plucked, they vibrate. These vibrations take the form of sound waves that travel to our ears, in this case, through the air around us. Vibrations make different sounds depending on their speed. If the vibration is slow the sound is lower, if it is fast the sound is higher. This is called pitch.
In the glasses of water, the less water in the glass the slower the vibrations and so the lower the sound. Adding more water to the glass will speed up the vibrations and make the sound higher. With the elastic band, the shorter the band plucked the faster the vibration and the higher the sound. Musical instruments change the speed of the vibrations to create different pitched notes and this is how music is made.

TOP TIP The children could explore tightening the band by turning one of the pencils. Can they predict how this will change the sound?

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16. Floating Boats

There are two key forces that act on any object in water: the upthrust of the water and the weight of the object. Upthrust is the force of the water pushing the object upwards. Weight is the force of gravity pulling the mass of the object down. For something to float, these two forces acting on the object need to be balanced. This balance can be affected by the shape the boat, which can change how much water the boat displaces. The more water the boat displaces the more it will float and therefore the heavier it can be. Objects that float are said to be buoyant. Life jackets help people to float because they are filled with air. The air reduces the downwards force and increases the person's buoyancy.

TOP TIP Ask the children to record how many small objects their boat can take. Does where they place the object in the boat make a difference? Can they repeat their findings to check their results?